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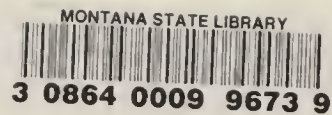
MONTANA

...bringing the land back to life



**A GUIDE TO
ABANDONED MINE RECLAMATION**

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Montana has always been on America's frontier -- in the early days of the country's westward expansion -- in providing the raw materials to build and defend our growing nation -- and no less now, leading the way in innovative abandoned mine reclamation -- bringing the land back to life.

The Honorable Marc Racicot
Governor
State of Montana

INTRODUCTION



Block P Mine

The State of Montana is well known for its scenic beauty as well as for its mineral resources. Montana's economy is now heavily based on its diverse recreational opportunities and also on the important contribution of industry sectors such as mining. Today, mining companies are required to provide fully bonded reclamation plans before they are able to obtain permits to mine in the State of Montana.

Unfortunately, some mining practices of the past created conditions which still exist and threaten the welfare of Montana's citizens and their environment. The harmful effects of these practices have existed for decades and, unless direct action is taken, these conditions will continue to degrade the state's environment. That is why the Montana Department of Environmental Quality's (DEQ) Abandoned Mine Reclamation Bureau was formed.

To date, Montana has addressed many long-abandoned mine and mill sites -- 283 projects so far. These sites had dangerous structures, open shafts, and hazardous materials. Many of these old mine and mill areas were seriously degrading the surrounding lands and water. Now they have been restored and revegetated.

Although much has been done, much remains to be addressed. The Montana Abandoned Mine Reclamation Bureau is working to reclaim Montana's mine lands to help ensure a productive future for the state and to bring its land back to life.



Belt Montana [ca. 1900]. (Montana Historical Society, Helena, used by permission).

MONTANA'S MINING HISTORY

Coal Mining

The Lewis and Clark expedition journals contain the first reference to coal deposits in Montana. In 1805, Meriwether Lewis noted his observation of coal seams along the banks of the Missouri River. Three quarters of a century later, Montana was a burgeoning state. People needed a cheap, accessible fuel for steamboats, railroads, homes, communities, and for the newly built smelters in the gold and silver mining areas of western Montana. Smelters in Great Falls, Anaconda and Wickes burned coke made from Montana coal. Over the years, coal has continued to be vital to Montana's industrial development.

Extensive, reliable rail service was available by the end of the 1880's. Railroads enabled the territory to export grains, fruit, meat, wool, gemstones, and precious metals. Within the territory, rail transportation was needed for metals, lumber, food, supplies, mail and people. Railroad promotional efforts encouraged more settlers and tourists to

come to Montana every day. Shortly after the turn of the century, three large trans-continental railroads traversed the state. These railroads were powered by steam and the steam was generated by coal.

By 1907, the smelters and railroads had developed large underground mines and coal processing plants at Timberline, between Bozeman and Livingston; at Stockett and Belt, in



Cottonwood Coal Company, Stockett, Montana, showing tipple. (Montana Historical Society, Helena, used by permission).

the Great Falls coal field; at Red Lodge, in Carbon County; and at Roundup, on the Musselshell River.

These coal mining areas were usually dominated by one large industrial complex owned by a railroad or smelting company. Smaller-scale satellite mines catering to local domestic and commercial coal needs clustered around the dominant mine. Located on or near the mainline railroad tracks, these mine complexes included coal processing plants which cleaned and sorted huge tonnages of coal dug from extensive underground workings by men who came from all over the world. Coal companies employed hundreds of workers and built whole towns to house the miners. Red Lodge, Montana was once such a coal company town.



Mine No. 1, Lehigh, Montana [ca. 1924]. (Montana Historical Society, Helena, used by permission.)

The abundance of cheap coal was also instrumental in making homesteading and ranching possible. The average farm or ranch used from five to ten tons of coal per year. Without this cheap and accessible source of fuel, it is doubtful that ranchers, homesteaders and small communities could have survived the long cold winters in eastern Montana. Up into the 1950's, people living and working in Montana continued to rely on domestic coal. This was especially so during the depression years of the 1930's. To survive those hard times, people depended on the inexpensive coal that could be brought up from small local mines.

More recently, compared to the role of other industries, the role of coal mining has diminished. Now, only one underground mine, located near Roundup, still operates in Montana. These days, Montana's coal industry is characterized by the development of a handful of large open-pit mines located in the eastern and southeastern areas of the state. Although the technology used is far different, these coal mining operations continue to tap the same vast deposits of coal which lie under Montana's surface and were noted so long ago by Meriwether Lewis.



Mine No. 2, Lehigh, Montana [ca. 1924]. (Minnesota Historical Society, used by permission.)

Non-coal Mining

The stream gravels along Gold Creek in Powell County Montana are credited with producing the first gold discovered in the territory that was to become the State of Montana. Granville and James Stuart, recently from California, had heard the tale of a Hudson Bay Company fur trader who found gold near their camp. So, in 1858, the Stuarts set out to find gold with the tools they had. When they indeed confirmed the presence of gold, they named the stream for it.

In fact, Gold Creek wasn't particularly rich, but rumors of gold brought gold seekers to Montana. In 1862, the first big discovery was made at Bannack on Grasshopper Creek. Then, in 1863, gold was discovered in Alder Gulch and Virginia City, which soon supplanted Bannack as the premier gold camp in Montana. The year 1864 saw discoveries at Helena, Silver Bow Creek, Confederate Gulch, Jefferson City and other locations as the gold rush spread to hundreds of gulches throughout Montana.

Most of the gold seekers came with only a pick and shovel to look for the golden nuggets, flakes, and dust. Others came also with the knowledge that gold could be found in the native rock of the surrounding hillsides and they spent their time searching for the motherlode. In 1862, miners near Bannack had constructed a crude water powered stamp mill from old wagon parts and were busy pounding the gold from the quartz on the Dakota Lode. In 1864, a steam powered stamp mill was hauled overland by mule train all the way from St. Louis to the Stuart Mine near present day Granite, Montana. By 1866, a mill brought up on a Missouri River steamboat was at work extracting gold from rock at Unionville south of Helena.



Gold panning "Nelson Gulch on Rimini Road-Jerry Robinson & Ike Newcomer." (Montana Historical Society, Helena, used by permission.)

Inexpensive and reliable transportation was essential for miners to make large-scale lode mining profitable. The equipment and chemical reagents that went into the processing needed to be brought into the territory from outside. Rich ores that couldn't be processed locally had to be sent out of Montana for smelting -- often overseas. Without transportation, the capital needed to develop mines, mills and smelters could not be attracted to the state. As a result, the 1870's saw the population of Montana Territory decline as the bonanza placer deposits were depleted. The lode mining industry awaited the development and outside capital that would be brought about by improved transportation.

In June of 1883 things began to turn around for Montana's miners when the Northern Pacific Railroad reached the gold mining town of Helena. With better transportation finally available, lode mining expanded throughout the 1880's until it became the territory's major industry, attracting sufficient capital to support large-scale operations. At the same time, the railroads facilitated the introduction of new technology that made it feasible to develop the rich silver deposits that had been discovered but not yet mined.

In 1878, passage of the Bland-Allison Act requiring silver purchases by the United States mint made silver the metal of choice for miners throughout the West. By 1883, Montana's silver production was second only to Colorado. By 1887, Montana led the nation. The Butte District was Montana's largest producer of silver. The Granite Mountain and Bimetallic mines at Phillipsburg were thought to be the largest single sources of silver in the world. Development of

the rich silver deposits at Wickes, Hecla, Rimini, Castle, Elkhorn, and Neihart further expanded Montana's production. This silver boom in Montana saw the construction of beautiful and elaborate mansions in Butte and Helena -- symbols of an economy which was expanding throughout the state.

During the expansion of lode mining in the 1880's, important new advances in gold and silver mining technology were making it feasible for smaller mines to exploit the deep lodes and make a profit. Finally, large smelters were built at Wickes, Anaconda and East Helena. Together these developments made mining on a world scale forever a part of Montana's history.



Anselmo Mine Headframe, Butte, Montana.

Then in 1893, silver prices collapsed as a result of high grade ore depletion and the repeal of the Sherman Silver Purchase Act, which withdrew the monetary status of silver. Most of the great silver mines and mills closed. The Butte District, however, was able to fall back on copper, which was needed for electric wire in the expanding electrification of the country. Some of the mines would be reworked with each rise in prices or with the development of markets for base metals. Today the legacy of bimetallism lives on in Montana's ghost towns with their sagging buildings, rusting equipment and decaying mining structures.



Anselmo Mine Headframe, pulleys at top, Butte, Montana.

The 1890's saw a new technological innovation -- cyanide processing. Cyanide processing brought gold camps to life in the Judith Mountains and the Little Rockies. Cyanide extraction allowed for the mining and processing of previously unprofitable gold ore. Some of the first applications of the technology took place in Montana. Any gold-bearing ore, including waste from previous mining operations, could be run through a diluted solution of sodium cyanide and the gold leached out. Cheap and easy, cyanide processing ultimately doubled world gold production.

In the early twentieth century, miners in Montana focused on copper, zinc, manganese and lead. Although gold and silver prospecting continued, most operations were small-scale with limited production. During the first half of the twentieth century, numerous small operators tried re-opening old mines and working nearby low-grade ore bodies. Ultimately, Montana's copper mines were a far greater source of wealth than were the early gold and silver mines. Gold and silver continued to be produced, but usually as by-products from the processing of other ores.

In an effort to mine other materials, miners developed some small non-metallic mineral deposits. One example was the Gravelly mine near Avon, which produced phosphates during the 1930's and 1940's. Another was the Vermont Marble Quarry near Radersburg, which shipped high quality building marble in the early 1930's.

There was continued activity into the 1920's in the mineral districts. But as the non-mining population increased and other economic influences became more dominant, there grew an awareness of the environmental and community hazards associated with mining. Cities brought lawsuits against mining companies for the pollution of municipal water supplies by mining wastes. Farmers and citizens' groups complained and sued over tailings deposited on streamsides.

Other hazards were more direct and sudden. In 1925, an earthquake broke the tailings dam at the Silver Dyke Mine and a 50-foot mudflow swamped miners' homes, killing two children and leaving the miners homeless. As the economic power of downstream communities increased, attempts were made to increase the safety of mine waste disposal and prevent pollution.



Golden Messenger Mine.

Following a slow period in the 1930's, World War II revived industrial mining in Montana and throughout the west. The war effort created a demand for base metals and production increased. But in 1943, the United States government issued an order closing all gold mines as non-essential to the war effort. Once again, the government's action led to abandonment of mining operations and a shift to other enterprises.

The economic effect that the mining industry has had on Montana is difficult to assess in a few words. Today Montana remains one of the most important producers of precious and non-precious metals in the United States. While some mines have made huge profits for their investors, mining development officials often saw their profits eaten up by low returns and legal fees from the many court disputes. Some historians estimate that, in the long run, with costs eating up the profits, the mining west has just about "broke even." Profits aside, mining has enriched Montana's local economies in indirect ways through taxes,

wages, transportation, purchases of supplies and materials and the early development of the West.

In the end, the cultural legacy of mining in the State of Montana may prove to be its most significant contribution. Mining attracted many people of such various origins and cultures that Montana's communities were enriched by their multicultural influence. Also, the early mining days left Montana with fascinating ghost towns which are explored each year by thousands of visitors. Indeed, many would say that, in spite of the scars that it has left in its wake, mining also embodies the American idea of adventure and freedom - that, with hard work, anybody can achieve wealth and success in one lucky instant.

THE MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY

MISSION STATEMENT

The Department of Environmental Quality's mission is to protect, sustain, and improve a clean and healthful environment to benefit present and future generations.

The Montana Department of Environmental Quality (DEQ) is an agency of the State of Montana. In addition to its other duties, DEQ is responsible for regulating mining and the restoration of lands disturbed by mining activities. DEQ is divided into five divisions:

- Centralized Services
- Permitting and Compliance
- Planning, Prevention and Assistance
- Enforcement
- Remediation

The Permitting and Compliance Division is responsible for permitting modern mining operations. Montana's Abandoned Mine Reclamation Bureau is part of the Remediation Division and it is responsible for reclamation of historical (pre-1977) mining-related disturbances.

Mining Permits

Montana was one of the first states in the nation to have a mine regulatory program. Many of the provisions found in Montana's mine permitting law were mirrored in the federal mining statute, the Surface Mining Control and Reclamation Act of 1977 (SMCRA). SMCRA is administered by the

Department of the Interior, Office of Surface Mining Reclamation and Enforcement (OSM).

When the United States Congress enacted SMCRA, it intended, in part, to assure that surface coal mining operations were conducted so as to protect the environment and promote the reclamation of mined areas once mining was completed. Another purpose of SMCRA was to address old coal and non-coal mining sites that were left without adequate reclamation prior to the enactment of the federal mining law.

There are two aspects of federal and state mining laws: for modern mining activities, establishing a plan of reclamation as part of the permitting process; and for the old abandoned mine sites, providing a source of funding for reclamation in the areas that were abandoned prior to the establishment of a regulatory program. The funds to accomplish these purposes are derived from the modern-day coal mining industry.

DEQ permitting staff are responsible for overall management, policy development, coordination and evaluation of Montana's mine regulatory program. DEQ also contracts with other agencies, universities, schools and private entities for such things as environmental impact statement preparation and data management. Three kinds of mining activities are regulated in Montana: coal, hard rock, and opencut.

DEQ has a federally approved coal regulatory program and administers several state laws: The Montana Strip and Underground Mine Reclamation Act; the Montana Strip and Underground Mine Siting Act; the Metal Mine Reclamation Act; and the Montana Environmental Policy Act with respect to mine-related regulation. DEQ must determine whether or not to issue or deny mining permits, complete on-the-ground compliance evaluations, enforce mining and prospecting operation laws, and determine whether or not reclamation by a mining company has been successful so that bonds can be released.

DEQ's state regulatory functions are closely coordinated with those of federal authorities at OSM. By cooperative agreement with OSM, DEQ administers SMCRA on federal lands in Montana. DEQ staff must also coordinate its regulatory activities with other federal agencies such as the Bureau of Land Management, the Forest Service, the Fish and Wildlife Service and the Environmental Protection Agency.

To ensure mining industry compliance with Montana's reclamation laws, a multi-disciplinary staff conducts technical, scientific and legal analyses of mining operations and reclamation plans for mines and prospecting activities.

Staff responsibilities include the exploration licensing, mine permitting, bonding, regulatory management of large mining operations (greater than 5 acres), producing environmental impact statements or five acres. The state does require permits for small mine environmental assessments, and managing the small miner exclusion program.

Montana's small miner exclusion law covers the activities of miners disturbing less than acres engaging in cyanide processing and also bonds for small miner cyanide, placer, and dredge operations. DEQ staff must assure that reclamation is completed by small miner placer and dredge operations before the bonds are released.

DEQ must also ensure mining industry compliance with all applicable laws and state environmental program requirements for air quality, water quality, dam siting, and preservation of cultural resources. Throughout the mine permitting process, the general public, public interest organizations and environmental interest groups must be kept informed. So another important component of DEQ's work is providing the public with information through meetings and the preparation of informative documents.

Abandoned Mine Reclamation

DEQ is responsible for administering abandoned mine reclamation grants obtained from the federal government. The agency provides administrative personnel and procures services related to abandoned mine reclamation. These grants are provided out of funds collected from the coal mining industry under SMCRA. DEQ project managers are responsible for large individual operating budgets for Montana's many reclamation construction projects. DEQ staff also manage the growing volume of public files, maps and information about abandoned mines in Montana.

On December 27, 1989, Montana's Governor, Stan Stevens, certified to the United States Department of the Interior Office of Surface Mining that the State of Montana had addressed all of its known coal-related reclamation problems which were eligible for funding under SMCRA. Montana was then approved to use SMCRA funding for non-coal reclamation. The restoration of lands affected by non-coal mining began in 1990 and is ongoing today.

If SMCRA funds are to be used for a reclamation project, the site must be eligible under the strict criteria of federal law. To be eligible for SMCRA funding, sites to be reclaimed must have been mined or affected by mining processes and abandoned or left in an inadequate reclamation status prior to August 3, 1977 (or prior to August 28, 1974 for U.S. Forest Service administered lands; and November 26, 1980 for U.S. Bureau of Land Management administered lands).

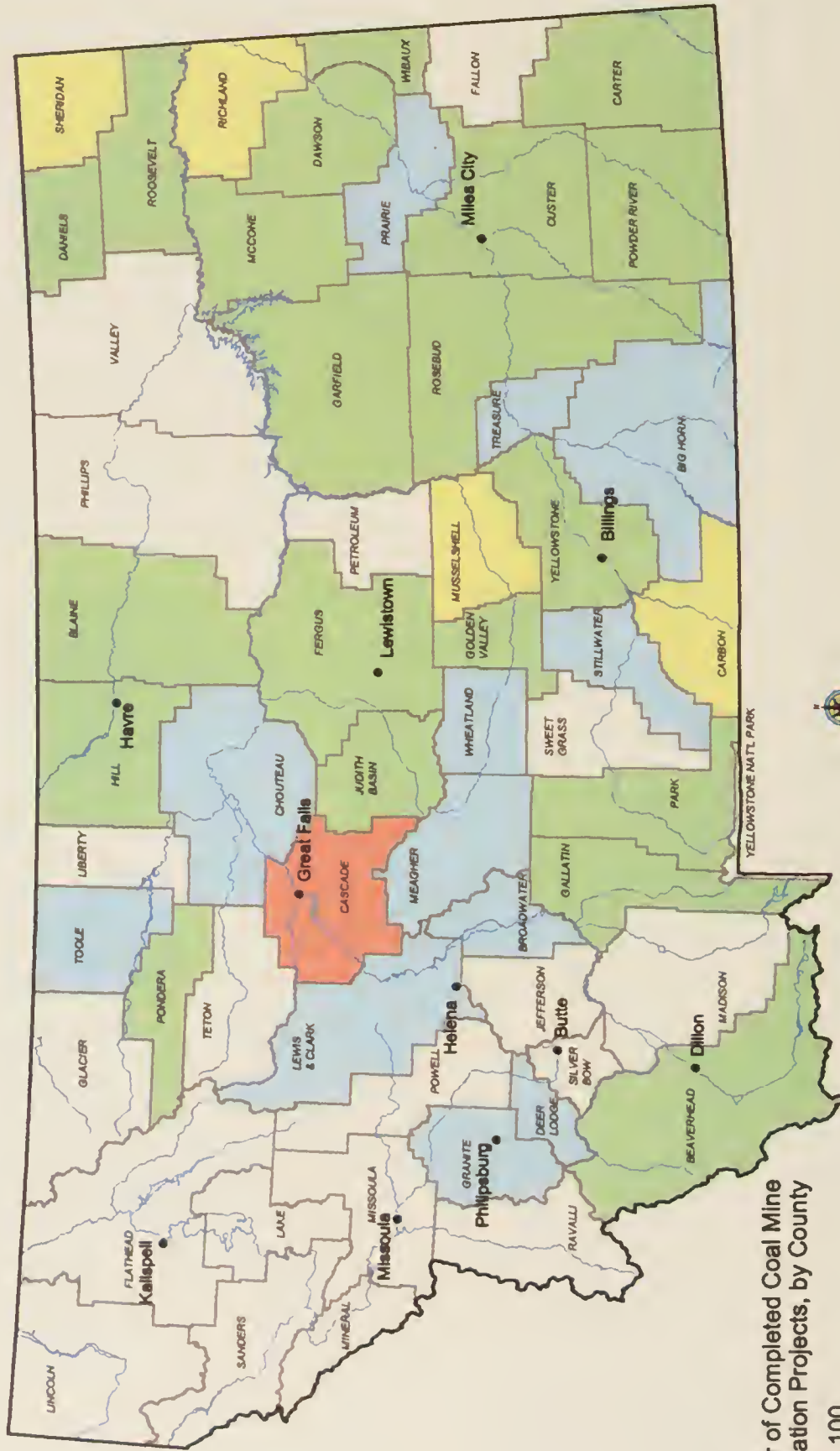
SMCRA funded sites can only be those that are truly abandoned -- where there is no one who can be held responsible for the needed reclamation. One statutory eligibility criteria is that there must be no continuing reclamation responsibility under state or federal laws on the part of owners, operators, or others connected to the past mining operations on the site. Also, a proposed SMCRA reclamation site cannot be within an area that has been designated for remedial action under the federal uranium control law or under the federal "superfund" law.

In certain limited instances, coal mining sites which were operated after 1977 up until November 24, 1990 may be eligible for SMCRA funded reclamation. These are situations where funds available from a bond, financial guarantee or other source were not sufficient to provide for adequate reclamation. Also, some sites may benefit from SMCRA funds if a coal company surety became insolvent between August 4, 1977 and November 5, 1990 and the funds available from bankruptcy proceedings were not sufficient for adequate reclamation. Other than these two limited exceptions, a privately owned site must have been abandoned prior to August 3, 1977 to be reclaimed with SMCRA funds.

DEQ technical staff includes professionals of all relevant scientific disciplines, including geology, hydrology, cartography, biology and archaeology. These trained people develop and manage several large reclamation construction projects across Montana each year. DEQ's attorneys provide legal counsel and interpretations of state and federal mining statutes and other environmental laws that affect the reclamation program. One attorney is housed with the abandoned mine reclamation staff to advise on legal issues, oversee the contracting and bidding process, and make SMCRA eligibility determinations for proposed abandoned mine reclamation projects.

To date, Montana has addressed many long-abandoned mine and mill sites on both private and public lands. Before they were reclaimed, these old mines and mills with rotting unsafe structures and large adits or openings in the ground endangered people and animals. Many were also seriously degrading Montana's environment. Now they have been reclaimed and revegetated. Indeed, today it would be difficult to tell that some of these restored Montana lands were ever disturbed. Structures that could be stabilized and made safe were left in place as historic artifacts for the benefit of the public. These sites remain as important places for people to come and reflect on Montana's mining history.

Completed Abandoned Coal Mine Reclamation Projects in Montana



Number of Completed Coal Mine Reclamation Projects, by County

- > 100
- 51 - 100
- 6 - 10
- 1 - 5
- None

Scale 1:4,000,000



Montana AMRB, 1995
 Base data prov. NRIS
 Map produced by: Integrated Geosciences, Inc. Helena, MT

Averting water from tailings dam failure at the Comet Mine.



FUNDING ABANDONED MINE RECLAMATION IN MONTANA

Montana's Abandoned Mine Reclamation Bureau is funded by a per ton tax assessed at the national level on coal production. This abandoned mine reclamation fund was established by the Surface Mining Control and Reclamation Act of 1977 (SMCRA). The money is made available through congressional appropriation. Each year, The State of Montana must apply to the United States Department of the Interior (OSM) for construction and administrative grants.

DEQ uses Montana's yearly grants to reclaim areas disturbed by pre-1977 mining where there is no private party with continuing reclamation responsibility under federal and state laws. Most abandoned mine sites are reclaimed using only federal funds and at no direct cost to Montana's taxpayers. Occasionally, an abandoned mine site is only partly eligible for SMCRA funds. When this is the case, some funds collected at the state level are used to supplement the funding package. In this way, for a minimal expenditure of state funds, DEQ can reclaim entire areas which logically should be addressed as one construction project.

The coal mining assessment, set by SMCRA, is 35¢ for every ton of surface coal mined and 15¢ a ton for underground tonnage. At current production levels, the annual nationwide tax amounts to more than \$250 million. Through February, 1996, \$4,036,611,383 had been collected since the program's inception -- \$45,473,091 in Montana. The projected unappropriated balance in the federal fund for the end of fiscal year 1996 is \$977 million. Montana's 1996 grant for abandoned mine reclamation was \$3.627 million. This included \$125,000 for emergency reclamation.

Montana's abandoned mine reclamation work is largely privatized. Thus, each year, abandoned mine reclamation projects in Montana provide income and employment for dozens of construction and engineering companies and hundreds of workers.

To date, Montana's abandoned mine reclamation program has overseen the completion of more than 283 projects totaling nearly 1,174 acres and touching 50 counties in the state.

PRIORITIZING RECLAMATION

Now that it has completed its eligible coal reclamation sites, the State of Montana is concentrating on non-coal reclamation. DEQ has investigated and prioritized known abandoned hard rock mine sites to look for environmental problems related to past mining activity and determine whether reclamation is necessary. Federal law requires that sites be addressed in a priority order:

- **Priority one.** The protection of public health, safety, general welfare and property from the extreme danger of adverse effects of mineral mining and processing practices.
- **Priority two.** The protection of public health, safety, and general welfare from the adverse effects of mineral mining and processing practices; and
- **Priority three.** The restoration of land and water resources and the environment previously degraded by the adverse effects of mineral mining and processing practices.

DEQ abandoned mine reclamation staff has expanded upon this basic three-tiered model. As a result of its investigative effort, DEQ has been able to develop a comprehensive and detailed priority listing of Montana's abandoned mine sites. The Abandoned Mine Reclamation Bureau Priority Sites List represents a thorough assessment of site conditions and an evaluation of each site's urgency with relationship to other sites.

The Tenmile Creek drainage basin map shows abandoned mine sites dotting the area. Many are near water flowing toward City of Helena public water supply intakes (page 11).

The Map of Montana's abandoned/inactive hardrock mine priority sites shows their concentration in southwest Montana (page 12).

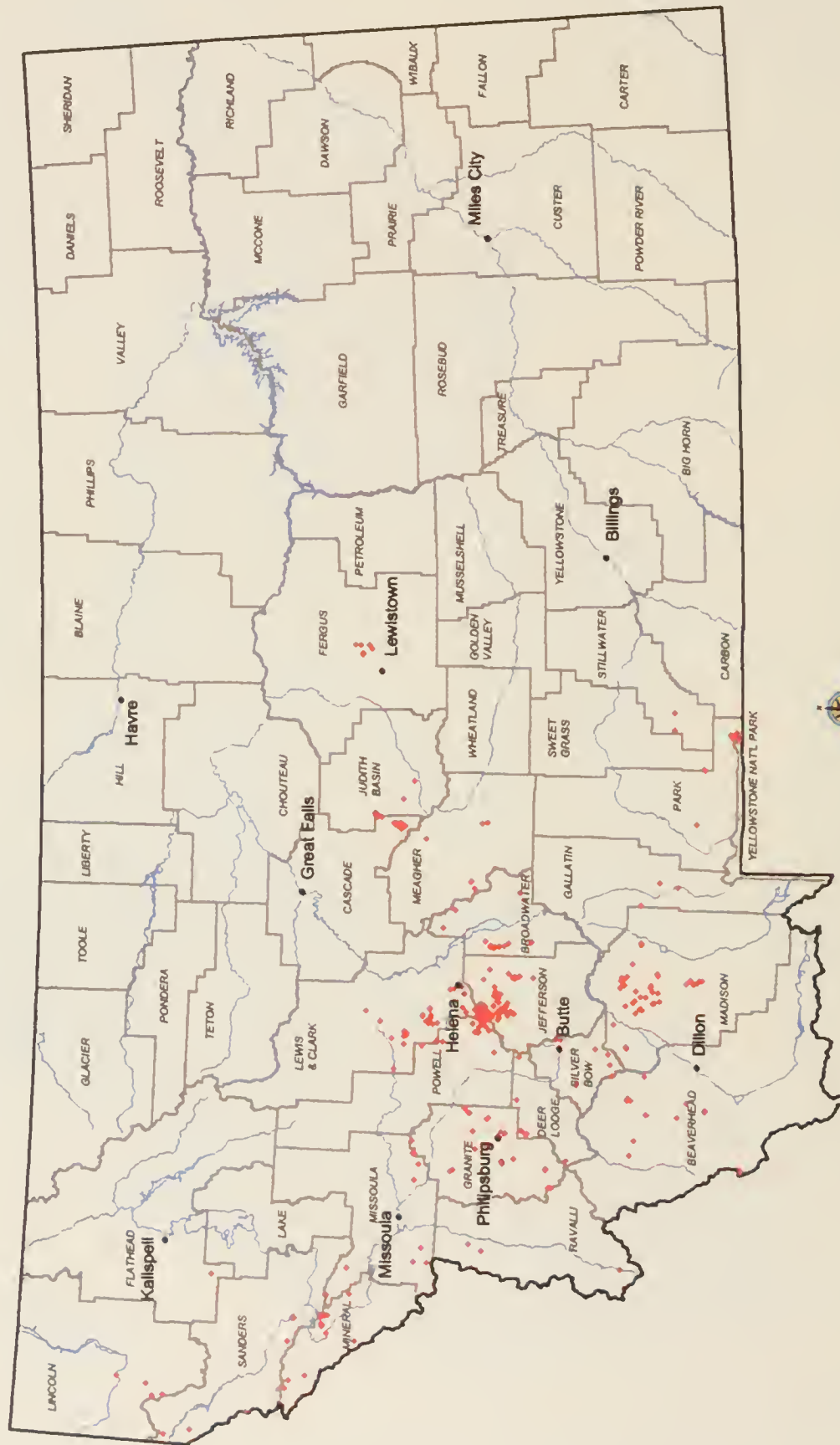
Abandoned Hardrock Mine Sites Upper Tenmile Creek Drainage Basin



- Basin Outline
- Abandoned mine sites
- Creeks
- ◆ City of Helena
- ◆ Drinking water intakes

Base data provided by NRIS
 Map produced by:
 Integrated Geoscience, Inc.
 Helena, MT

Abandoned/Inactive Hardrock Mine Priority Sites



Scale 1:4,000,000



Abandoned/Inactive
Hardrock Mine Priority Sites



Montana DEQ AMRB, 1995

Base data provided by NRIS
Map produced by:
Integrated Geoscience, Inc.
Helena, MT

Every known abandoned hard rock site on Montana's priority list has undergone a thorough scientific assessment of on-site conditions and off-site impacts. Using geographic location equipment, DEQ prepared site maps showing tailings piles, ponds, streams, structures, etc. Water, rocks, soils and sediments were sampled to identify the presence of hazardous materials or chemicals. Volumes were calculated for tailings or waste rock piles. Particular note was taken of conditions such as discharging adits or waterflows around and through tailings and hazardous mine openings. The information generated from the inventory effort has been compiled in reports and maps which are available to the public at the DEQ Abandoned Mine Reclamation office in Helena.

The more serious or threatening the conditions, the sooner the sites are scheduled for work. As a result of this effort, several of Montana's worst sites have already been reclaimed. 294 sites remain on the priority list, but many of these are already being addressed. Although much remains to be done, DEQ's decision to find out which problems were the worst and take care of them first is already yielding many success stories.

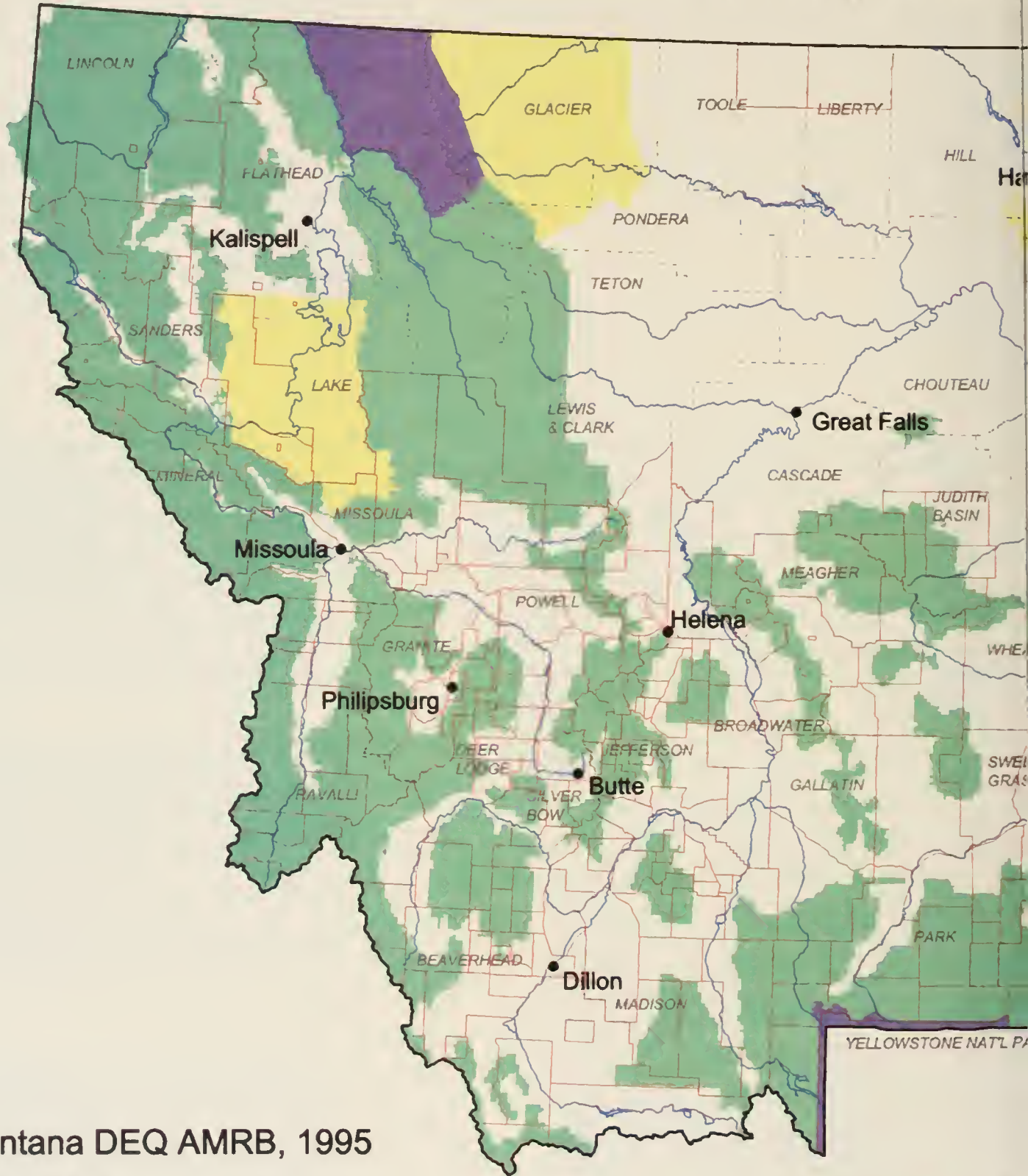
MINING DISTRICT MAP

In 1994, the State of Montana's Abandoned Mine Reclamation Bureau researched and developed a map of Montana's hardrock mining districts. When necessary, historic boundaries were modified slightly to fit a site inventory, and to resolve confusions between the names of historic placer mine districts and lode districts. In some cases, new districts were created to organize data on mines located in areas outside of historic districts (page 13).

Examples of Priority Sites



Mining District

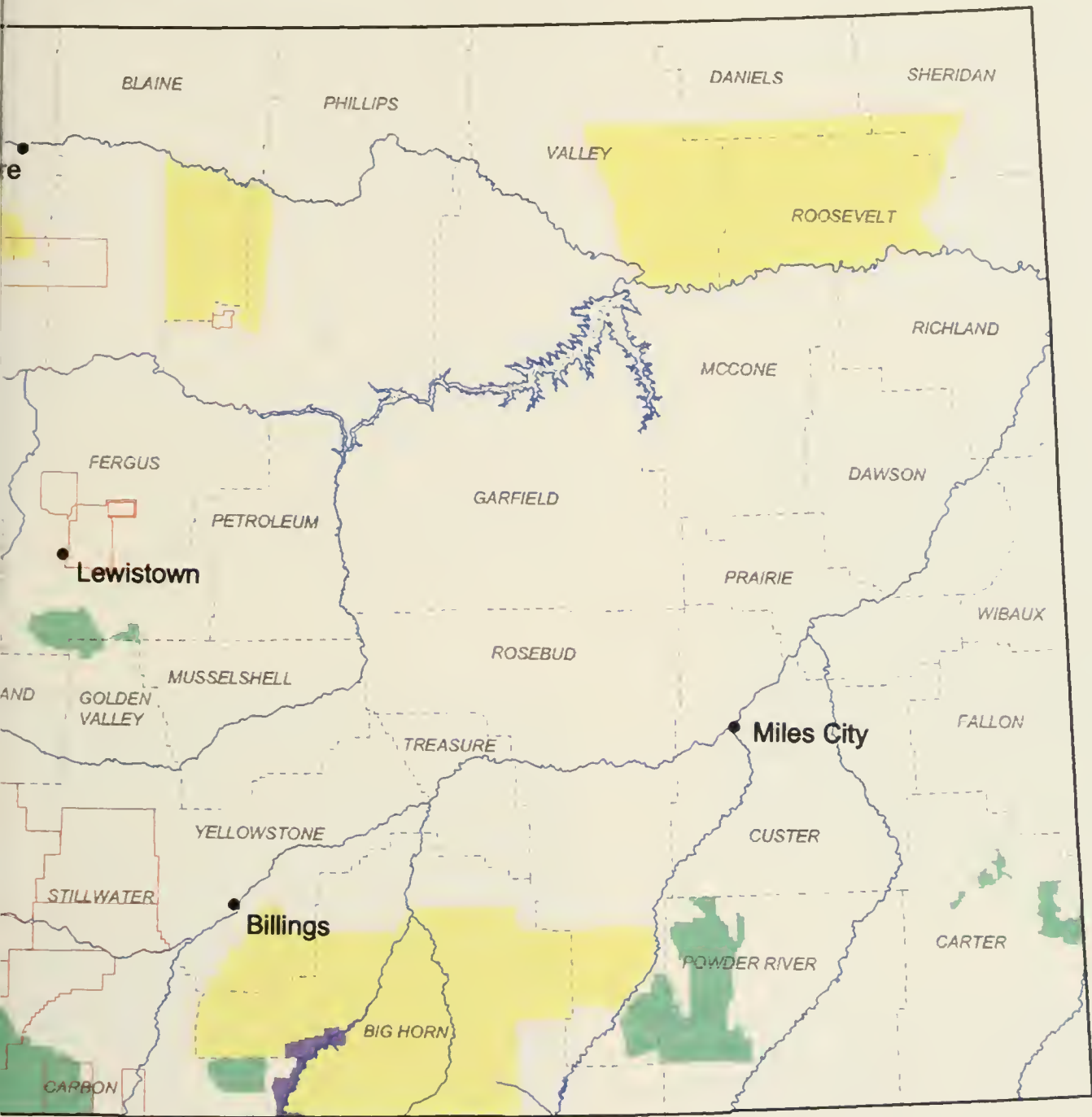


Montana DEQ AMRB, 1995

Map produced by:
Integrated Geoscience, Inc.
Helena, MT



ts of Montana



- Mining Districts
- - - County Boundaries
- National Forest
- National Park
- Indian Reservation

Map data provided by NRIS. Mining district data based on the Montana Bureau of Mines and Geology Memoir #15, plate 1, 1935; and Uuno M. Sahinen, "Mining Districts of Montana", M.S. thesis, Montana Tech, 1935.

PROBLEMS ASSOCIATED WITH ABANDONED MINES

The majority of Montana's fifty-six counties have had abandoned mine problems. These problems might be associated with former coal or non-coal mines, or they may be associated with abandoned gravel pits.

Abandoned mine sites may have various conditions including highwalls, toxic materials, acid water, trash, abandoned structures or equipment, lack of drainage control, barren spoil, nonproductive or low productive grazing and farmlands, lack of an acceptable vegetative cover, undesirable surface water bodies, adverse impacts on residential areas and surrounding communities and others.



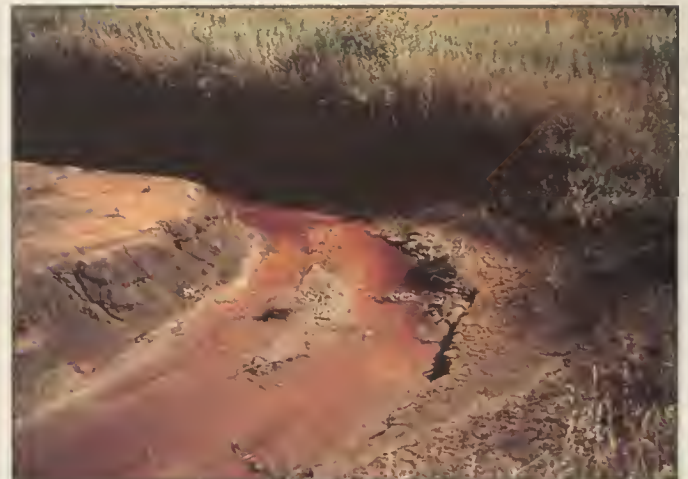
Giffen Mine, Cascade County, Montana.



Giffen Mine, Cascade County, Montana.

The abandoned mine reclamation staff also work on abandoned gravel pits. Located around the state, gravel pits can pose a particular danger, since they are typically located near residential neighborhoods. They might be areas where children play and are often used by recreational vehicle enthusiasts. With abandoned gravel pits, DEQ's first task is to inventory the known sites across the state and document any problems they may pose. Approximately 1,500 sites in sixteen counties have been identified so far. The inventory process results in a hazard score for each site. This score takes into account health, safety and general welfare information, the physical condition of highwalls, potential dangers below the highwall, roads located above the highwall, and the danger of falling from the top of the highwall.

The work of reclaiming abandoned mine lands involves various dangerous tasks such as filling open mine shafts, burying mining and processing wastes in a manner that protects the environment of the surrounding area and subsequent users of the land, and restoring water quality. This kind of work, in itself, presents dangers which must be addressed through private insurance coverage and hazardous materials handling training requirements which protect the workers and also the State of Montana.



Sand Coulee Creek below Tracy, Montana.

Each abandoned mine site is addressed according to the severity of its different impacts to the surrounding land. These impacts can include the following kinds of problems and more:

- ◆ acid mine drainage
- ◆ contaminated waters
- ◆ sterile soils
- ◆ collapsing structures
- ◆ hazardous shafts and adits
- ◆ subsidence holes in yards, streets & fields
- ◆ highwalls
- ◆ mine fires
- ◆ air pollution
- ◆ erosion
- ◆ residential flooding

Sometimes, site characteristics and the condition of the land after abandonment may preclude full restoration, but it is the goal of the reclamation plan for every mine site to restore the land as near as possible to pre-mining uses.

RECLAMATION WORK

Before Construction



Brooklyn Mine before reclamation. Outhouse overhangs creek shore.

Each year, the State of Montana receives its allocation of abandoned mine reclamation funds granted to states by the federal government through the United States Department of the Interior Office of Surface Mining Reclamation and Enforcement (OSM). Before any reclamation can be done on a specific project, DEQ must request funding through an individual project grant application process. Each grant application with its associated documents is prepared and coordinated by DEQ staff. As sites are chosen based on their

priority, applications are submitted to OSM for approval as specific projects to be funded under the program grant.

Early on, the DEQ project manager must determine the current ownership of the land and whether there are any mining claims at the site. Experienced researchers verify ownership and obtain copies of official documents recorded in the deed records of county clerk and recorder's offices and other locations. Once the landowners have been identified, the project manager contacts each landowner that can be located. At this time, the landowner may give input about the proposed reclamation project. Every effort is made to incorporate landowner requests into the reclamation design wherever possible. Project managers have found that, once they explain abandoned mine reclamation projects, owners nearly always grant consent.

If it appears that a priority site is eligible for SMCRA funds, the DEQ abandoned mine reclamation project manager begins the grant application task. The project manager assesses the risks to people and the environment, establishes cleanup goals, and analyzes the cost of various reclamation alternatives. During the grant phase of each reclamation project, the public has an opportunity to comment upon the project design and work plan. The project manager is also responsible for obtaining all the necessary permits and complying with federal and state environmental and historic preservation laws and regulations.

Once a preferred alternative is chosen, the project manager must submit a grant application to OSM describing the proposed project and the work plan. Once the cleanup alternative is chosen and all necessary permits and clearances have been obtained, DEQ sends a complete project application package to OSM. Each application package includes information about the proposed project site condition, a site history, and a description of the proposed reclamation work.

Other decision-making documents are included in the application package such as a legal eligibility determination, environmental review documents, and consultation letters from other agencies that have been contacted for comment or approval. Some of the agencies which comment on reclamation projects and impact the decision-making process include the United States Fish and Wildlife Service and the State Historic Preservation Office.

If federal officials decide that funding the project is appropriate, OSM issues a Finding of No Significant Impact and Authorization to Proceed. Because of Montana's short construction season, the project manager must move quickly to get the reclamation completed before bad weather sets in again.

DEQ advertises the reclamation construction project for three consecutive weeks in five major newspapers and one local paper. Bid packages are sent to building exchanges across the state and sold at cost to interested persons or firms. Before a project is bid, the DEQ project manager holds a pre-bid meeting with potential bidders so they can fully understand the work that needs to be done and the equipment and qualifications necessary to complete the job before they submit a bid.

On the specified date, the project manager opens all bids in a public bid opening and the lowest qualified bidder is notified. DEQ then verifies the contractor's compliance with necessary insurance and bonding requirements and prepares a Notice of Award and an Agreement for the contractor's signature. Then the site work can begin.

Construction Phase

Once the bid is accepted, the project manager and engineer hold a pre-construction conference with the selected contractor to clarify lines of authority and communication. They review construction plans in detail so that any questions can be resolved. Following this meeting, the project manager issues a notice to proceed and the contractor begins the construction work, which must be completed by the contract completion date. After months of planning and design work, depending on the size of the problem to be addressed, the construction phase of a typical reclamation project often takes just two to four months.

Construction tasks necessary to reclaim an old mining site vary, but they usually include such things as:

- ◆ moving large amounts of material;



- ◆ removal of dangerous structures and debris;



- ◆ filling or blocking hazardous openings . . .



- and shafts;



◆ diverting streamwater away from contaminated areas;



◆ closing adits;



◆ placement of topsoil;



◆ revegetation.



◆ installing gates and fencing;



◆ replanting.



Work plans are very detailed and they include specific requirements for all aspects of the project work. Some of these details are included at the request of a landowner. Most work plans include requirements of particular concern to landowners, such as provisions for speed and weight limits on trucks, a traffic control plan, sediment control, site cleanup, maintenance of fences, weed control, protection of archaeological and historical features or findings, and so forth.

Throughout construction, DEQ directly oversees the progress of the work. Project managers conduct frequent on-site inspections and assistance to ensure that each step in the reclamation process proceeds as planned and engineered.

Once the construction is completed, the project manager and the engineer conduct a final inspection to insure contractor compliance with the work plan. Final payment will not be made to the contractor until the completion of a successful final inspection.

The non-coal reclamation process is illustrated in the Abandoned Inactive mine Cleanup Procedure Flowchart (page 20).

After the Reclamation Construction

In the years following the reclamation project, DEQ monitors the success of the reclamation. The project manager goes to the site frequently to monitor the success of revegetation and other aspects of project construction. If necessary, contractors are called back to the site to re-do certain parts of the reclamation work.

If a problem develops at a site in the years after reclamation, DEQ addresses it. For instance, DEQ plants vegetation native to the surrounding area where the reclamation project is located. The spread of invasive noxious weeds is always a concern, so weed control is part of every reclamation project design. Sometimes, for different reasons, new plants on a reclamation site are not successful. When that happens, DEQ staff return to the site to re-plant native trees, grasses or shrubs in the problem area so that a stable vegetative cover can take hold and grow on its own.



Vegetative cover taking hold.

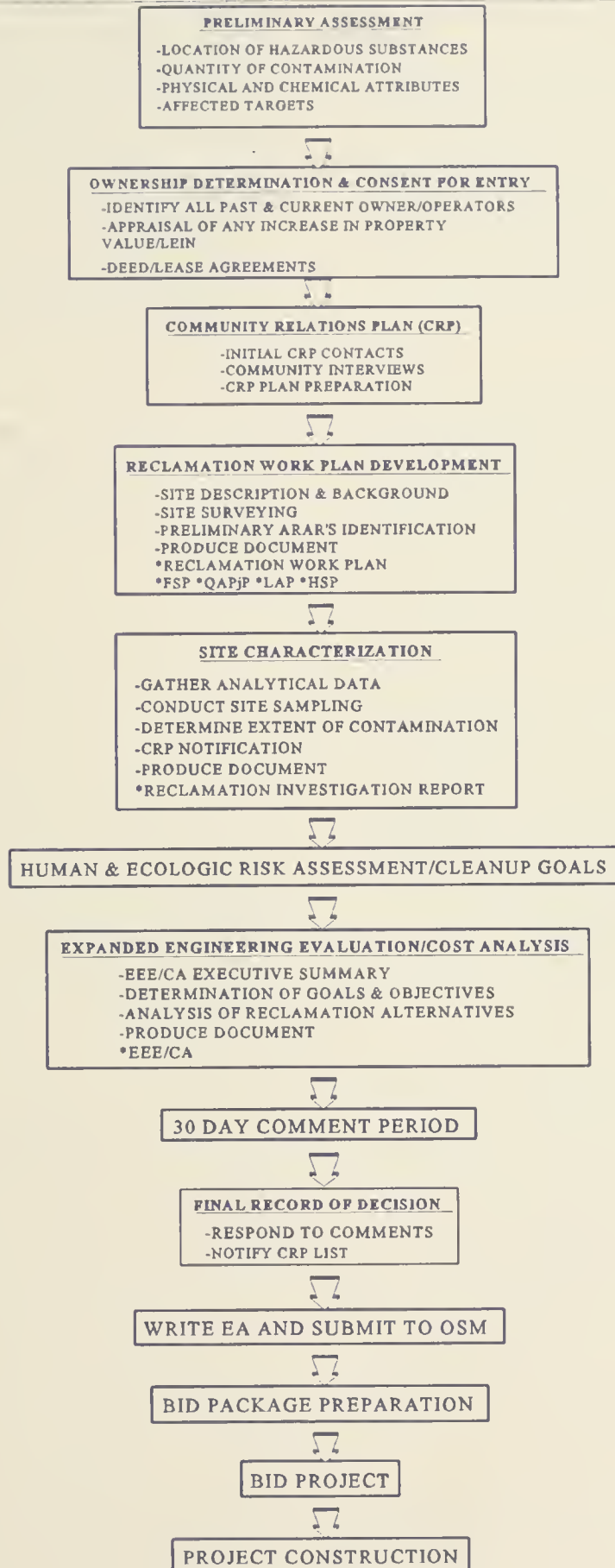


New construction on a reclaimed gravel pit.



Brooklyn Mine with reconstructed stream after reclamation.

ABANDONED MINE RECLAMATION



PUBLIC PARTICIPATION IN RECLAMATION PROJECTS

The public is an important component of each abandoned mine reclamation project. DEQ involves the local community in the site investigation and reclamation plan so that the concerns of people affected by projects can be identified and addressed. The local public might be concerned about a variety of things such as warning signs, fencing, previous unsuccessful efforts at reclamation, historic structures, financial responsibility, the level of cleanup, and other such issues.

In the community relations component of the reclamation process, information is provided to the interested public about all aspects of the project: the historical background of the site, the management of heavy equipment mobilization, dust, stormwater and other issues. Staff provide the public with a complete site description, including its geology, hydrology, topography and vegetation. Special emphasis is given to site contamination issues, whether they involve solid media, water or air.

Community concerns are addressed either individually or at public meetings. Public meetings are held during public comment periods, when important information becomes available, or upon the request of local citizens. DEQ staff give a brief history of abandoned mine reclamation activities in Montana, the funding source(s) for the reclamation project, and legal authorities. They explain how a particular site is chosen to be addressed ahead of others. A reclamation work plan goes to every public meeting, along with copies of site access consent forms and a complete site topographic survey.

Public meetings help DEQ to gain input about a site's reclamation goals and objectives. The public's input on draft planning documents is incorporated into those documents. As the project unfolds, DEQ might conduct additional meetings to update people about recent findings. All public meetings are held locally and DEQ staff encourages audience participation. Meetings are announced in local newspapers and are held in the evening to facilitate the participation of daytime working residents. Meeting speakers cover topics in layman's terms and utilize photos and maps to help explain the reclamation effort. Project experts such as the engineer or historic preservation specialist attend as well to fill in the important details and answer questions.

Project managers also contact local residents individually by telephone, mail, and in person. Residents' concerns regarding the site are noted and recorded, and addressed in whatever

way is possible. Often the work plan can be altered to accommodate the concerns of affected citizens.

DEQ provides project reports and status updates on site activities to all who ask. Copies of site documents, maps and photographs are on file at DEQ and made available at public meetings. Press releases are used to distribute information such as meeting announcements, new dates, and other important project information. Press releases always include the names and phone numbers of DEQ personnel to contact for further information.

The abandoned mine reclamation staff is always willing to meet members of the public who become actively involved in reclamation projects one-on-one. All project file information is available for public viewing at DEQ abandoned mine reclamation staff offices, and the DEQ location address and phone number is given out at meetings. For each project, there is a public information contact, usually the project manager. If the project manager is unavailable, calls and visits can be directed to abandoned mine reclamation supervisors.

LANDOWNER INVOLVEMENT

Early in the planning stages of reclamation, The Department of Environmental Quality staff contact landowners so that they may be involved in the process. Owners are always asked to consent to the reclamation of abandoned mines on their property, and owner involvement and requests are important factors in project design and operations. During and after the construction phase of projects, staff keep landowners informed about the details and progress of the reclamation effort. Sometimes landowners have particular requests. For instance, a landowner might have a preference about the route that trucks take to the area being reclaimed. If DEQ can implement a request in an economically feasible way and still meet reclamation goals, landowner requests are accommodated.

DEQ goes to considerable effort to identify and locate property owners at a proposed reclamation site. A thorough search of the public records is done so that landowners, mining claim holders, and any known leaseholders can be contacted early. Reclamation staff personally visit with owners and area residents on their preliminary visits to the site so that owners and other interested persons can have a chance to ask questions and talk about the work that needs to be done. These meetings are also an opportunity for reclamation staff to learn more about the operational history of the site, since a landowner's historical knowledge is critical to the design of the reclamation project.



Land owners and DEQ staff visit sites as part of the reclamation design process.

Although state law does not require it, written consent is DEQ's preferred means for carrying out reclamation activities. The Montana Department of Environmental Quality has the authority to carry out necessary non-consensual reclamation if it finds that:

1. Land or water resources on the property have been adversely affected by past mining practices;
2. These adverse effects are at a stage such that it is in the public interest to take action to restore or reclaim the property or to abate, control, or prevent the adverse effects of past mining practices; and
3. The owners of the land or water resources where entry must be made to restore or reclaim the property or to abate, control, or prevent the adverse effects of past mining practices are not known or readily available or the owners will not give permission for the Department or its agents to conduct the reclamation.

DEQ takes considerable care and effort to locate and inform landowners. But sometimes, consent cannot be obtained. When landowners can be located, it is rare that they withhold consent. Most owners are very pleased that their land will be restored.

The Montana legislature decided that when private lands are reclaimed at public expense, if possible, some of the funds should come back to the public where there is an increase in value. Therefore, when private land is reclaimed with abandoned mine reclamation funds, Montana has discretionary authority to place or waive a lien on the reclaimed land. This would only occur if the reclamation results in a significant increase in fair market value of the private land at public expense.

The DEQ must first determine whether there is likely to be a significant increase in the fair market value of the private property. If so, an independent appraiser is hired to appraise the property before the reclamation begins. Once reclamation is complete, the appraiser does another appraisal to determine the actual increase in fair market value. If the increase turns out to be insignificant, no lien is filed.

A lien will not be placed against the property of a surface owner who acquired title prior to May 2, 1977 if the owner did not consent to, participate in, or exercise control over the mining operation which necessitated the reclamation work.

Even if the reclamation will significantly increase the fair market value of private property, DEQ may waive the filing of a lien under three circumstances:

1. If the cost of filing the lien, including indirect costs to the State of Montana exceeds the increase in fair market value as a result of the reclamation;
2. If the reclamation work performed on privately owned land primarily benefits health, safety or environmental values of the greater community or area in which the land is located; or
3. If reclamation is necessitated by an unforeseen occurrence and the work performed to restore that land will not result in a significant increase in the market value of the land as it existed immediately before the occurrence.

FREQUENTLY ASKED QUESTIONS

What information is available about old mine sites and where can I get it?

The DEQ Abandoned Mine Reclamation office in Helena houses files, maps, photographs, test results, and other information about abandoned mine sites in Montana. This information is available for public inspection and copies may be made at the DEQ office.

How does the state decide what sites will be reclaimed first?

By law, DEQ must give priority to abandoned coal mines. Montana has completed reclamation of its abandoned coal mines, but if any new problems occur, DEQ will address them right away. DEQ is now addressing abandoned non-coal mines. These have been ranked in priority order based on an abandoned and inactive mines scoring system and a safety score. The non-coal abandoned mines are being addressed on a roughly worst-first basis. If a site is on the federal "superfund" list or if it is being addressed privately or by another government agency or program, DEQ cannot reclaim the mine site with SMCRA funds.

How can I tell if a site is on the priority list?

The abandoned mine reclamation priority site list is available at the DEQ office in Helena, Montana. It is not necessary, but it would be helpful to have information pertaining to the site such as the name of the nearest town, the section number, township and range numbers, the mine name and when it was mined.

Is the abandoned mine reclamation work done on my property going to cost me money?

No. Eligible abandoned mine reclamation projects are paid for out of a national trust fund that is paid for by coal mining companies' payment of a fee assessed for each ton of coal that is mined in the United States.

What will happen if I don't sign the consent form?

DEQ must do all things necessary to restore the land and prevent further adverse effects from past mining practices. If DEQ finds that land or water resources have been adversely affected by past mining practices and it is in the public interest to take action, the agency has the authority to reclaim private land without owner consent. However, DEQ prefers to obtain the consent of landowners for its reclamation activities and makes considerable efforts to do so.

Do I have any say in the reclamation plan?

DEQ locates owners and keeps them involved and informed about the planned reclamation activities throughout the process. Sometimes, landowners have specific requests concerning the design of reclamation projects which can be accommodated. Every effort is made to incorporate landowner requests if they are compatible with the project and are economically feasible.

Who actually does the reclamation work on my land?

DEQ's uses its own professional staff and others from the private sector such as engineers, geologists, chemists, biologists and construction contractors who are experienced in mine reclamation to carry out DEQ's reclamation plan. Contractors must assure DEQ that they are qualified to perform the necessary work and that the specialized equipment needed will be available to get the job done within the short project time frames.

What if something happens during the project? Will I be liable?

The qualified professionals who are hired to design and carry out reclamation projects are required to have private insurance with high policy limits, and landowners as well as the State of Montana must be named insureds.

Will DEQ fix up my house if it is on an abandoned mine site?

No. The funds allocated to DEQ for abandoned mine reclamation under SMCRA are to be used for the restoration of lands, water, and public facilities that were adversely affected by past mining activities. Structure repair would be the responsibility of your insurance carrier. If your home or other property is damaged by an active mine, contact DEQ's regulatory branch for appropriate action.

Will the same land uses I have now be available to me after the reclamation is complete?

Yes, with one exception. Once land is reclaimed with public funds, by statute, it may no longer be mined under a small miner exclusion from the Montana reclamation laws. Otherwise, DEQ's reclamation adds no further limitations on a landowner's use of property.

Will I be able to farm or have cattle graze my ground after reclamation?

Although there is no formal restriction on future land use, at least for a while, reclaimed land is fragile and should be treated as such. For instance, often, seeded areas are

fenced for a time to ensure successful revegetation. In those instances where the site contains adequate topsoil for replacement use, the land can be farmed or grazed after two years if proper land management techniques are practiced. For the most part, reclaimed abandoned mine lands are not suitable for intensive farming and landowners are cautioned against plowing or other practices (such as overgrazing) that could destroy the vegetation or cause erosion, which may expose buried materials.

When will I know if a lien will be placed on my property?

In the planning stages, before a project is sent out for bids, DEQ makes a determination whether the publicly funded reclamation would significantly increase the fair market value of private property. If no significant increase is likely, no lien is filed. If a lien is to be filed, before and after appraisals must be done by an independent appraiser. The amount of the lien is not determined until the reclamation is complete because the lien filed must be for the lesser of either the cost of the reclamation or the actual increase in the property value (as established by the independent appraisal). Under certain circumstances, DEQ may waive the filing of a lien.

Will my property taxes increase after the reclamation work is completed?

Usually, no. Most of the time, the DEQ's conclusion is that the reclamation effort will not significantly increase the fair market value of the property. However, a landowner's taxes are determined by the tax assessor in the county where the property is located.

I own the surface, but not the mineral rights on my property, will reclamation affect that in any way?

No. Other than the restriction on the availability of the small miner exemption, any existing mining rights will be unaffected.

How can I report a dangerous abandoned mine site?

Call the DEQ abandoned mine reclamation program offices in Helena. Or, you could call the Governor's Office of the Citizens' Advocate at 800-332-2272 (in Helena, 444-3468). The Citizens' Advocate will be able to arrange for someone to call you back who can address your concerns.

SOME MINING TERMINOLOGY...

acid mine drainage:

Water containing sulfuric acid having a pH of less than 6.0 and discharging from an active or abandoned mine and/or the surrounding affected area. When exposed to air, water or weather processes, acid forming earthen materials containing sulfide minerals (principally iron pyrite) oxidize and form the sulfuric acid. This sulfuric acid mixes with the water to form acid mine drainage, which flows out of the mine into surrounding lands and waters.

adit:

A horizontal or nearly horizontal opening excavated from the surface of the earth for the working of a mine. If the opening were dug through a hill or mountain to the surface on the opposite side, it would be a tunnel.

approximate original contour:

The surface land configuration achieved in reclamation by backfilling and grading previously mined areas so that the reclaimed area closely resembles the general surface configuration of the land and surrounding area prior to mining.

bond forfeiture:

When a company fails to perform mining and reclamation procedures in accordance with the reclamation plan approved as part of a State of Montana permit to mine, the bond is collected by the State and that money is used to reclaim inadequately restored land to a productive status.

certification:

Formal approval certification of a state abandoned mine reclamation program by the United States Department of the Interior. The State of Montana's program was certified and thereby gained authority to administer its federally approved abandoned mine reclamation program at the state level on November 24, 1980.

coal processing waste (gob and slurry):

The materials from the earth that are separated from the coal product during cleaning or processing.

coal seam:

A bed or layer of coal in the earth.

compliance:

Conducting coal, mineral or other extraction and reclamation activities in accordance with the requirements of Montana and federal laws and regulations.

concentration/concentrate:

The process of reducing the values in an ore into a form which has a smaller bulk in order to diminish the expense of shipping and treatment. Concentrate is the name for the reduced ore material which contains the valuable metal from which most of the waste material has been eliminated. Once the concentrate is produced, it is sent to smelters for further treatment.

cyanide/cyanidation:

A salt or ester of hydrocyanic acid which produces a chemical reaction in leaching operations in metal mine processing. Cyanidation dissolves metal values from gangue materials for later recovery. The practice consists of fine grinding the entire tonnage on a roller, tube, rod, or ball mill. The crushed ore then passes to leaching tanks where a solution of sodium or potassium cyanide is added to a tank with ore. The ore then gives up the silver or gold mineral into solution so that the gold and silver can be retrieved in zinc boxes or by other methods. The precipitate that results can then be smelted and refined into gold and silver bullion.

DEQ:

The State of Montana Department of Environmental Quality. DEQ's mailing address is P.O. Box 200901, Helena, Montana 59620-0901.

disturbed area:

An area of land or surface water that has been disturbed by mining activities. The term includes the area from which the overburden, vegetation, topsoil, tailings, waste materials, minerals or coal have been removed, as well as areas where topsoil, spoil, or mine processing waste were placed by surface mining operations. Disturbed area also includes tailings ponds, waste dumps, roads, conveyor systems, leach dumps and all similar excavations or coverings that result from mining operations and that have not been previously reclaimed.

dredge:

A floating placer mine operation. One example is a bucket dredge, where buckets scoop up gravels to be screened, sorted and sluiced. Gold stays on the sluice boxes while waste gravels and sand wash back into the creek or are sent by conveyor to stacks in the creekbed behind. The dredge was developed in New Zealand in the 1880's and first successfully worked in Montana in 1895 in the Bannack District.

dump:

A pile or heap of waste rock material or other non-ore refuse near a mine.

effluent limits:

Limitations on the amount and quality of water leaving a project area.

gangue:

The worthless minerals that are associated with the valuable minerals in an ore. As much of this gangue as possible is removed by the processes of concentrating and smelting.

gob:

Rock or other coarse materials sorted out of coal either during mining or processing. Gob has the consistency of pea-gravel or driveway stone.

groundwater:

Subsurface water that fills available openings in rock or soil materials to the extent that they are considered water saturated.

highwall:

The vertical wall consisting of the material being mined and the overlying rock and soil strata (overburden) of the mining site.

imminent danger to health and safety of the public:

Existence of any mining related condition or practice or any violation of a permit or other requirement of Montana law in a mining or reclamation operation that could reasonably be expected to cause substantial physical harm to persons outside the permit area before the condition, practice, or violation can be abated.

impoundment:

A closed basin, naturally formed or artificially built, which is dammed or excavated for the retention of water, sediment, or waste.

land use:

Specific use or management-related activity, rather than the vegetation or cover of the land. Some categories of land use in Montana are cropland and occasional hay cutting, pasture, forestry, developed water resource, recreational, fish and wildlife habitat, residential, industrial/commercial, and undeveloped.

leaching:

The removal in solution of the more soluble minerals by percolating water or extracting a soluble metallic compound from an ore by selectively dissolving it in a suitable solvent, such as water, sulfuric acid, hydrochloric acid, cyanide, etc. A leach pad is a specially prepared area covered by an impervious liner on which ore is placed for leaching. A leach tank is a specially constructed tank in which ore is placed for leaching.

lode:

A mineral deposit in solid rock.

mill:

A mineral processing facility which is a building with machines for grinding and pulverizing ores and extracting metals or producing a product. A mill might have rock crushers and grinders for ore, vats for mixing chemicals with the crushed ore, and machinery for capturing the desired product.

mineral

In the reclamation context, a mineral is any ore, rock, or substance (other than oil, gas, or uranium) that is taken from below the surface or from the surface of the earth for the purpose of milling, concentration, refinement, smelting, manufacturing, or other subsequent use or processing or for stockpiling for future use, refinement, or smelting.

mining:

The process of obtaining useful minerals from the earth's crust including both underground and surface workings. In Montana, digging gravel and topsoil from the earth is also considered mining.

mulch:

Vegetation residues or other suitable materials that aid in soil stabilization and soil moisture conservation, thus providing conditions suitable for seed germination and growth.

opencut mining:

The mining of bentonite, clay, scoria, phosphate rock, sand, or gravel by removing the overburden lying upon natural deposits directly from those deposits leaving them open to the surface. An example of an opencut mine under Montana law is a quarry, which is a surficial opening or pit from which building stone such as granite, marble, slate, etc. is extracted.

ore:

A mineral or mineral aggregate which contains precious or useful metals and occurs in such quantity, grade and chemical combination as to make extraction commercially profitable. An **ore body** is a solid and fairly continuous mass of ore which may include low grade ore and waste as well as high grade materials. An **ore deposit** is a general term applied to rocks containing minerals of economic value in such amount that they can be profitably exploited. The term is also applied to deposits which, though they may not be immediately capable of profitable exploitation, may yet become so by change in the economic circumstances that control their value.

ore processing:

Milling, heap leaching, flotation, vat leaching, or other standard hard-rock mineral concentration processes; and, in the open-cut mining context, crushing, screening, and asphalt or concrete plants.

OSM:

The United States Department of the Interior's Office of Surface Mining Reclamation and Enforcement. This is the federal agency that oversees the work of state agencies enforcing the federal coal mining and reclamation law.

overburden:

All of the earth and other materials that lie above a natural mineral deposit and the earth and other material after removal from their natural state in the process of mining.

panning:

The hand placer process utilizing a circular steel dish from 10-16 inches in diameter at the top and from 2 to 2.5 inches deep with sloping sides at 35-40 degrees. By swirling stream water with a gyratory motion, miners could sort gravel in the pan, pour off the larger particles, and leave the finer heavier materials, such as gold.

pH:

A symbol for the degree of acidity or alkalinity of a solution. pH values from 0 to 6 indicate acidity and from 8 to 14 indicate alkalinity. A solution with a pH of 7 is considered neutral.

placer mining:

The extraction of naturally occurring, scattered or unconsolidated valuable minerals from gravel or alluvium lying above bedrock. Placer mining is also called "dredge mining." Miners remove unwanted sedimentary material with running water which traps the metal ore in sluice boxes.

pyrite:

A lustrous yellow mineral which is a common iron sulphide occurring abundantly as native ore and serving principally as a source of sulfur in the formation of sulfuric acid in acid mine drainage.

reclamation:

Actions taken to restore mined land or to abate, control or prevent the adverse effects of mining as required by Montana and federal law to a post-mining land use approved by the DEQ.

reclamation specialists:

Staff members of the DEQ Remediation Division who obtain funding, design, and manage reclamation projects.

revegetate:

The act of planting reclaimed land with grasses, flowers, shrubs and trees.

sediment:

Matter that settles to the bottom of a liquid; matter deposited by water or wind (i.e. sand, silt, dirt, etc.)

shaft:

A vertical or steeply inclined excavation penetrating the earth's surface that is connected to a mine.

SMCRA:

The federal law called the Surface Mining Control and Reclamation Act of 1977, passed by Congress to establish minimum national standards for mining and reclamation, and to provide a funding source for the reclamation of abandoned mines.

smelting:

The chemical reduction of a metal from its ore and certain fluxes by melting at high temperatures. The non-metallic material floats on top of the heavier metallic constituents in the molten state and remains in that position when it cools and hardens.

soil amendments:

Additives to the soil to enhance its productivity, such as fertilizer or agricultural lime.

spoil:

Overburden material disturbed or removed from its natural state, or non-ore material removed in gaining access to ore or mineral material in the process of mining. Spoil and mining waste materials are disposed of or piled in waste dumps and spoil piles.

subsidence:

The collapsing of overburden materials resulting from underground mining or associated underground excavations that cause depressions or holes on the surface and damage to structures.

subsoil:

The layer of soil beneath the topsoil.

tailings:

The refuse material resulting from washing, concentrating or treating ground ore that is discharged from a mill. A **tailings pond** is a pond of water with a constraining wall or dam into which mill effluents are deposited.

topsoil:

The upper surface layer of soil, usually darker and richer than the subsoil, that is naturally present and necessary for the growth and regeneration of vegetation on the surface of the earth.

vegetation:

In the context of reclamation activities, vegetative cover is the type of vegetation, grass, shrubs, trees, or any other form of natural cover considered suitable at the time of reclamation. Usually, plants used to revegetate a reclamation site are those that are native to the surrounding area.

waste rock dump:

Waste rock that was mined and disposed in the vicinity of a mining operation, often at or near the entrance of an adit.



Glen Tungsten Mill site near Dillon, Montana just after reclamation. Straw mulch protects seed which will sprout in the next growing season.



Rimini Kelly Millsite hydromulched channel.

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